IT493US MAIKP105US

ELECTRICAL ARRANGEMENT AND METHOD FOR PRODUCING AN ELECTRICAL ARRANGEMENT

REFERENCE TO RELATED APPLICATIONS

This application claims the benefit of the priority date of German application DE 102 55 462.5, filed on November 25, 2002, the contents of which are herein incorporated by reference in their entirety.

FIELD OF THE INVENTION

The present invention is directed to optical components, and more particularly to an optical system arrangement and a method for producing such an optical arrangement.

BACKGROUND OF THE INVENTION

Optoelectronic components, in particular lasers and photodetectors, are frequently accommodated or "housed" in so-called TO housings. The signals are input and output via contact-making pins that are passed through the housing and are connected to the components by means of bonding wires. The bushings for the contact-making pins are glazed and are routed coaxially, thus offering hermetic encapsulation for the sensitive optoelectronic components. Furthermore, the TO housing shape is relatively compact and has a low price, since it is a standard product that is mass-produced. In particular, lasers that are accommodated in TO46 housings have become established as a type of standard product for optical data transmission over short and medium distances in the range up to 2.5 Gigabits per second.

The data rates for optical telecommunications are, however, currently in the range of 10 Gigabits per second or more, so that the said TO housings can no longer be used directly for optoelectronic components. Lasers and photodetectors with data rates of 10 Gigabits per second or more are thus nowadays offered in special housings composed of metal or ceramic. These housings are optimized for high frequencies and offer the capability to integrate further electronics, such as driver components or preamplifier components in them. However, housings such as these are manufactured only in very small volumes, so that the prices for such housings - also referred to as hybrid housings - are considerably greater than the cost of a TO housing.

SUMMARY OF THE INVENTION

One aspect of the invention is based on the object of improving the electrical characteristics of an electrical arrangement of the type described initially. This includes, in particular, the aims of achieving a better frequency response, for example a higher cut-off frequency, than in the case of the already known electrical arrangements.

Accordingly, the invention provides for at least one of the contact-making pins which are passed through the housing to touch the mount device, and, in the area of the touching point, for a connection without any bonding wires to be provided between this at least one contact-making pin and at least one conductor track on the mount device.

One major advantage of the electrical arrangement according to the invention is that its frequency response is better than that of the already known electrical arrangements. The electrical arrangement according to the invention can thus be used to achieve a higher cut-off frequency since no bonding wire connection for electrical contact making is required between the contact-making pin and the mount device; this is because, in the arrangement according to the invention, the mount device and the at least one contact-making pin touch one another such that an electrical connection without bonding wires is possible in the area of the touching point. Bonding wires, such as those that are required for making contact between the mount device and the contact-making pin in the already known electrical arrangements, always have additional line inductances, which decrease the cut-off frequency. This is where the invention comes into play, by dispensing with bonding wires for making electrical contact between the contact-making pin and the mount device; according to the invention, this is achieved by the mount device being mounted on the housing base plate of the electrical arrangement such that it touches at least one contact-making pin which is passed through and allows an electrical connection without any bonding wires.

A further advantageous development of the arrangement according to the invention provides for the mount device to have an edge recess, whose contour is matched to the contour of the at least one contact-making pin, in the area of the touching point. The matching of the contours of the edge recess and of the contact-making pin result in a particularly large-area electrical connection between the electrical contact-making pin and the mount device, so that a particularly low-impedance and secure electrical connection is possible

between the contact-making pin and the conductor track on the mount device.

In this context, it is regarded as being advantageous for the recess to be semicircular, because a semicircular recess on the one hand allows very simple adjustment and mounting of the mount device on the housing base plate and, on the other hand, it nevertheless allows a good electrical contact-making capability between the contact-making pin and the mount device.

In order to achieve a particularly large-area and thus low-impedance electrical contact between the mount device and the contact-making pin, it is regarded as being advantageous for the mount device to be metallized and/or to have a conductive contact-making layer in the area of the edge recess.

Another advantageous refinement of the electrical arrangement according to the invention provides for the mount device to have a contact-making hole in the area of the touching point, through which contact-making hole the at least one contact-making pin is passed. In contrast to the advantageous refinement of the invention as described above, in which the touching point between the contact-making pin and the mount device is located in the edge area of the mount device, the touching point in this refinement of the electrical arrangement is arranged in the internal area of the mount device.

In order to achieve a particularly large-area and thus low-impedance electrical connection between the contact-making pin and the mount device, it is in this context regarded as being advantageous for the inner

area of the contact-making hole to be metallized and/or to have a conductive layer.

The electrical contact between the at least one conductor track on the mount device and the at least one contact-making pin can be made particularly easily and thus advantageously by means, for example, of conductive adhesive. However, instead of this, it is also possible to solder the at least one contact-making pin and the at least one conductor track on the mount device to one another in the area of the touching point.

Soldering between the at least one contact-making pin and the at least one printed circuit board on the mount device can be achieved, for example, by means of a solder ball or solder platelet, either of which is applied to the at least one contact-making pin, and thus also to the at least one conductor track, in the area of the touching point.

As already indicated above in conjunction with the already known prior art, particularly stringent requirements for cut-off frequencies occur especially in the area of optoelectronics. It is thus regarded as being advantageous for the electrical component to be an electro-optical component, in particular an optical transmitting and/or receiving element. The electrical component may thus, for example, be a laser or a photodetector.

With regard to the at least one contact-making pin passing through the housing base plate, it is regarded as advantageous for the bushing to be a glazed coaxial bushing. Glazed coaxial bushings have the advantage that they allow the housing to be hermetically sealed.

Apart from this, it is regarded as being advantageous for the housing of the electrical arrangement to be a TO housing, in particular a TO46 housing, since housings such as these are available at very low cost since they are mass-produced, and, in consequence, this also reduces the costs of the overall electrical arrangement.

The mount device may advantageously be formed by a circuit mount.

The circuit mount is advantageously composed of silicon, of ceramic, of an organic material or of a metal that is provided with an isolation layer. Both metal and silicon have particularly high thermal conductivity, so that these materials allow the heat that is produced by the electrical component to be thermally dissipated particularly well.

Particularly high electrical cut-off frequencies can be achieved by removing or replacing, as much as possible, all the avoidable bonding wire connections; it is thus regarded as being advantageous for an electrical component having at least two connections for each of these connections to be electrically connected to a conductor track. In addition, it is advantageous for the mount device to touch at least two contact-making pins, which are routed to the exterior, and for the connection between the two conductor tracks and between the two contact-making pins to have no bonding wires.

In order to achieve as high a cut-off frequency as possible for the electrical arrangement, another aspect of the invention provides for the mount device to be mounted on a housing base plate such that the mount device touches at least one contact-making pin, which is routed to the exterior. The invention further

provides, in the area of the touching point, for a connection without any bonding wires to be produced between the at least one contact-making pin and the at least one conductor track on the mount device.

With regard to the advantages of the method according to the invention, and with regard to the advantages of the advantageous refinements of the method according to the invention, reference is made to the above statements relating to the electrical arrangement according to the invention, since the advantages of the method according to the invention essentially correspond to the advantages of the arrangement according to the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

In order to explain the invention:

Figure 1 shows an electrical arrangement according to the prior art,

Figure 2 shows an exemplary embodiment of an electrical arrangement according to the invention, which is advantageously produced using the method according to the invention, as described above, and

Figure 3 shows the frequency response of the electrical arrangement shown in Figure 2, compared to the frequency response of the electrical arrangement shown in Figure 1.

DETAILED DESCRIPTION OF THE INVENTION

Figure 1 shows an electrical arrangement according to the prior art, which has a TO46 housing 10 with a housing base plate 20. Four contact-making pins are passed through the housing base plate 20 and thus through the TO housing 10: a contact-making pin 30, a further contact-making pin 40 and additional contact-making pins 50 and 60. The four contact-making pins 30, 40, 50 and 60 are each passed by means of a coaxial glazed bushing 70 through the housing base plate 20 and through the TO housing 10 to the exterior, thus resulting in the TO housing 10 being hermetically sealed.

A mount device 80 is mounted on the housing base plate 20. A laser 90 is mounted as an electrical component on this mount device 80. One connection of the laser 90 is connected to an electrical conductor track 100 on the mount device 80. The conductor track 100 is also connected by means of a bonding wire 110 to one contact-making pin 30.

A further connection of the laser 90 is connected by means of a further bonding wire 120 to an additional conductor track 130. This additional conductor track 130 is connected via a third bonding wire 135 and via a fourth bonding wire 140 to the further contact-making pin 40.

Thus, as can be seen from Figure 1, the respective bonding wires 110, 120, 135 and 140 are provided for the electrical connection between the two contact-making pins 30 and 40 and the conductor tracks 100 and 130 on the mount device 80, and the laser 90 respectively. These four bonding wires have line inductances that have a very poor transmission

response, particularly at high frequencies. The cut-off frequency of the electrical arrangement shown in Figure 1 is reduced considerably by these bonding wires, so that maximum data rates of 8 to 9 Gigabits per second can be achieved with the electrical arrangement shown in Figure 1.

Figure 2 shows an exemplary embodiment of an electrical arrangement according to the invention. In this case, Figure 2 uses the same reference symbols for all those components that have already been explained in conjunction with the electrical arrangement shown in Figure 1.

Figure 2 shows the TO housing 10 on whose housing base plate 20 the mount device 80 is mounted. The laser 90 is located as an electrical component on the mount device 80. To this extent, the configuration of the electrical arrangement shown in Figure 2 corresponds to the configuration of the electrical arrangement shown in Figure 1.

A major difference between the electrical arrangement shown in Figure 1 and the electrical arrangement shown in Figure 2 is that no bonding wires are required for the electrical connection between the two contact-making pins 30 and 40 and the conductor tracks on the mount device 80. The electrical connection between one contact-making pin 30 and one conductor track 100 in the electrical arrangement shown in Figure 2 is thus ensured by the mount device 80 touching a contact-making pin 30 at the edge. For this purpose, the mount device 80 has a semicircular recess 200, whose dimensions are such that approximately half of one contact-making pin 30 can engage in the edge recess 200 in the mount device 80.

The edge recess 200 is in this case metallized so that an electrical connection is produced between that contact-making pin 30 and the edge area of the mount device 80. The one conductor track 100 is in this case electrically connected to the edge metallization of the recess 200, so that this results in an electrical contact between that conductor track 100 and that contact-making pin 30.

A corresponding situation applies to the connection of the further contact-making pin 40. This is because the mount device 80 has a further semicircular recess 210, whose dimensions are such that approximately half of the further contact-making pin 40 can engage the recess 210 in the mount device 80. The further recess 210 is likewise metallized at the edge, so that an electrical contact is formed between the edge of the further recess 210 and the further contact-making pin 40. Furthermore, there is a further conductor track 230 on the mount device 80, which is electrically connected to the metallized edge area of the further recess 210. The further conductor track 230 is thus also electrically connected to the further contact-making pin 40, without any need for a bonding wire.

Figure 2 thus shows that only very short bonding wires 300 are required to make contact with the laser 90, by means of which, specifically, the further connection of the laser 90 is connected to the further conductor track 230.

Thus, in the arrangement shown in Figure 2, no bonding wires are required for making contact with the two contact-making pins 30 and 40. This avoidance of bonding wires, that is to say in particular the bonding wires 110, 135 and 140 shown in Figure 1, is possible because the electrical contact between the two contact-

making pins 30 and 40 is ensured by the mount device 80 and the two contact-making pins 30 and 40 touching at the edge.

Overall, the electrical arrangement shown in Figure 2 thus has at least two fewer bonding wires than the electrical arrangement shown in Figure 1 since, specifically, no bonding wires are required for the electrical connection between the contact-making pins 30 and 40 and the associated conductor tracks 100 and 230 on the mount device 80.

The electrical arrangement shown in Figure 2 thus allows optoelectronic components to be integrated in a TO housing and at the same time to achieve data rates of 10 Gigabits per second or more, because the bonding wires which limit the frequency have been removed.

The electrical contact and the electrical connection between the two contact-making pins 30 and 40 and the edge metalization on the mount device 80, and thus to the two conductor tracks 100 and 230 on the mount device 80 can be produced by means of a soldering process or by means of conductive adhesive bonding.

A soldered joint may, for example, be implemented such that a small solder ball is in each case applied to each of the two contact-making pins 30 and 40.

The mount device 80 may be a circuit mount. The mount device 80 may, for example, be formed from silicon or ceramic, or from an organic material. Alternatively, the mount device 80 may also be composed of a metal that is provided with an isolation layer.

Figure 3 shows the frequency response of the electrical arrangement shown in Figure 2, compared to the

frequency response of the electrical arrangement shown in Figure 1. Specifically, Figure 3 shows the simulated reflection characteristic (S11) (Y-axis) of the two arrangements. As can be seen, the arrangement shown in Figure 2 can achieve considerably higher cut-off frequencies than the arrangement shown in Figure 1.

Although the invention has been illustrated and described with respect to one or more implementations, alterations and/or modifications may be made to the illustrated examples without departing from the spirit and scope of the appended claims. In addition, while a particular feature of the invention may have been disclosed with respect to only one of several implementations, such feature may be combined with one or more other features of the other implementations as may be desired and advantageous for any given or particular application. Furthermore, to the extent that the terms "including", "includes", "having", "has", "with", or variants thereof are used in either the detailed description and the claims, such terms are intended to be inclusive in a manner similar to the term "comprising".

List of reference symbols

10	TO46 housing
20	Housing base plate
30	A contact-making pin
40	A further contact-making pin
50, 60	Additional contact-making pins
70	Coaxial glazed bushings
80	Mount device
90	Laser
100	A conductor track
110	Bonding wire
120	Further bonding wire
130	Additional conductor track
135	Third bonding wire
140	Fourth bonding wire
200	Recess
210	Further recess
230	Further conductor track
300	Bonding wires